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Two New Cave-Dwelling Millipedes from Japan*

With 3 Text-figures

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ABSTRACT Two new species of polydesmid millipedes are described and illustrated from Japanese caves: *Epanerchodus angulatus* n. sp. and *Polydesmus tanakai* n. sp. The former is related to *E. bidens* Takakuwa described from a lava cave at the northern foot of Mt. Fuji. The latter new species is close to *P. miyosii* Murakami reported from Shikoku, and is the third record of the genus *Polydesmus* from the Japanese Islands.

More than fifty lava caves have been found at the foot of Mt. Fuji, and are known to harbour various kinds of cave-dwelling millipedes. As to the genus *Epanerchodus*, four (or five) different species have hitherto been recorded from some of these caves. They are as summarized in the following lines: *E. lobatus* Verhoeff (1941, p. 117, figs. 7–11) from a lava cave; *E. obliquitruncatus* Takakuwa (1954, pp. 98, 232, fig. 107), from a lava cave; *E. acer* Takakuwa (1954, pp. 110, 236, fig. 123), from a lava cave (?); *E. bidens* Takakuwa (1954, p. 109, fig. 127), from Saiko-kōmori-ana Cave; and *E. takashimai* Haga (1956, p. 337, fig. 2, pl. 1), from Komakado-kaza-ana Cave. The type-localities of the former three species have not been ascertained because of the indifference of the original authors. It is true that Takakuwa cited a name (Fuji-fūketsu) as one of the localities of his *E. obliquitruncatus* and *E. acer*, but he expressly indicated that the cave was in Shizuoka Prefecture. Contrary to this indication, there is no cave called “Fuji-fūketsu” in that prefecture. Takakuwa’s account should, therefore, be read as “a lava cave (fūketsu) in the Fuji area”, not as “the lava cave called ‘Fuji-fūketsu’”.

Takakuwa also made an incredible error in describing his *E. acer*. In the Japanese text (pp. 110–111) of his description, he cited “Fuji-fūketsu (Shizuoka Pref.)” as the type-locality of the millipede, whereas in the German text (p. 236), the type-locality is given as “Kawati bei Nikkō (Totigi Pref.)”. Accordingly, it is impossible even to determine if the type-specimen of *E. acer* was really taken in a cave. On

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the other hand the same author (1954, pp. 93, 108, figs. 125-126) redescribed *E. lobatus* on the basis of specimens taken in Komakado-kaza-ana Cave. As was already pointed out by Miyosi (1959, p. 99), Takakuwa's redescription and drawings do not accord with Verhoeff's original account. It is most probable that Komakado-kaza-ana Cave is not the locality of true *E. lobatus*, which still remains in obscurity.

The author has explained at some length on the inadequacy of investigations on the milliped fauna of lava caves at the foot of Mt. Fuji. His intention is to illustrate how difficult it is to identify certain forms which have close relationship with the milliped fauna of the Fuji area. As will be seen later, one of the new species described in this paper is closely allied to *Epanerchodus bidens*, originally described from Saiko-kōmori-ana Cave at the northern foot of Mt. Fuji. It is to be hoped that future investigations will clarify the milliped fauna of those lava caves and bring the accurate status of certain problematical forms to light.

Besides the new species of *Epanerchodus*, a new *Polydesmus* from the Ryukyus will also be described in the present paper. This milliped does not seem to be an obligatory cave-dweller, but is of high interest from the taxonomic point of view. The occurrence of the members of *Polydesmus* is very sporadic in the Far East, and the present new species is the third one of the genus known from the Japanese Islands.

The holotypes of the millipedes described in this paper and a part of the paratypes of *Epanerchodus angulatus* are deposited in the National Science Museum, Tokyo. Other specimens remain in the author's collection.

Epanerchodus angulatus n. sp.
(Japanese name: Izu Obiyasude)

Diagnosis: A medium-sized cavernicole related to *E. bidens* Takakuwa (1954, p. 109, fig. 127) in the form of body segments and the shape of gonopods, but distinguished from the latter by the male gonopods characterized in the following particulars: disto-ventral corner of femur markedly protuberant; tibiotarsus with a very long slender branch and a small acicular terminal seta.

Male holotype: Color pale reddish brown. Length about 21 mm, greatest width 4.1 mm. Body moderately broad; dorsum weakly sculptured, with wide lateral keels. The shape of head and of some selected segments as shown in text-figures; the widths of them as follows:

Head = 2.1 mm	Collum. = 2.4 mm	Seg. 2 = 2.9 mm
Seg. 3 = 3.1 mm	Seg. 4 = 3.4 mm	Seg. 5 = 3.6 mm
Seg. 6 = 4.0 mm	Seg. 11 = 4.1 mm	Seg. 15 = 4.0 mm
Seg. 16 = 3.8 mm	Seg. 18 = 2.3 mm.	

Head normal in appearance, subglobular, and densely covered with short hairs except for the back of vertex. Antennae slender, approximately 4.6 mm long, and reaching back to the posterior border of segment 4. Articles 2-4 cylindrical; article 5 subclavate; article 6 clavate; article 7 conical. Length relationship of

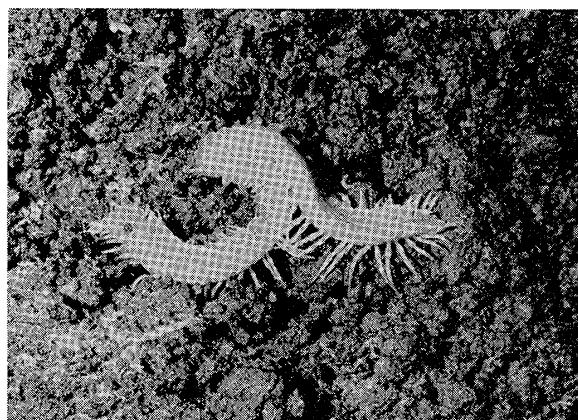


Fig. 1. A pair of *Epanerchodus angulatus* n. sp. in copulation; Ana-no-hara-dō Cave (Photo by M. Ohrui, 30 November 1968).

articles $3>4=5>6>2>7>1$; the ratio in length of articles 5 through 7 and in width (in parentheses) is 32(8): 24(10): 10(7); sensory groups on last three articles well developed. Collum elliptic, the sides moderately narrowed and raised; three rows of fine bristles present along the anterior margin and on the surface; surface polished, with weak sculpture on the mid-dorsal area; lateral notches and marginal groove entirely absent. Succeeding segments basically similar in structure to one another; dorsum slightly convex and with sculpture usual for a member of the genus. Lateral keels well developed, rather thin, nearly horizontal in mid-body segments, moderately reflexed in anterior ones, and wider than long (length/width ratios of segments 5-8 and 10 are 28: 38, 30: 43, 31: 42, 33: 44 and 35: 43 respectively). Anterior margin of typical keels slightly convex, entirely bordered, and the surface smooth. Lateral margin slightly convex with 3 or 4 weak notches. Posterior corners nearly rectangular in anterior segments, becoming slightly produced caudad from segment 9, and acutely produced on posterior ones. Pores open on the strongly depressed lateral margin near the fourth notch of pore-bearing keels. Sternites quadrate, pubescent, and with deep crossing furrow, all not produced on posterior corners; lateral portions of segment 6 markedly, and of segments 4-5 slightly rising, and densely covered with long hairs. Legs slender, last three podomeres of postfemur, tibia and tarsus with small spherical bristles; prefemur short, moderately protuberant on the upper side; femur slightly incurved; podomeres of prefemur and femur with dense, sickle-like bristles on ventral side; claw slender and curved, without accessory setae.

Gonopodal aperture large and broad, contained mostly in the metazonite. Gonopods as shown in Figure 2, E-I. Coxa large, subcylindrical and glabrous. Prefemur setose as usual. Femur distally broad and somewhat compressed; the disto-ventral corner markedly protuberant and especially chitinous; distal portion wide, subflat and rugose; no femoral clivus and outer horn. Tibiotarsus projecting ventrad, basally broad, distally laminated and attenuated, and with three small

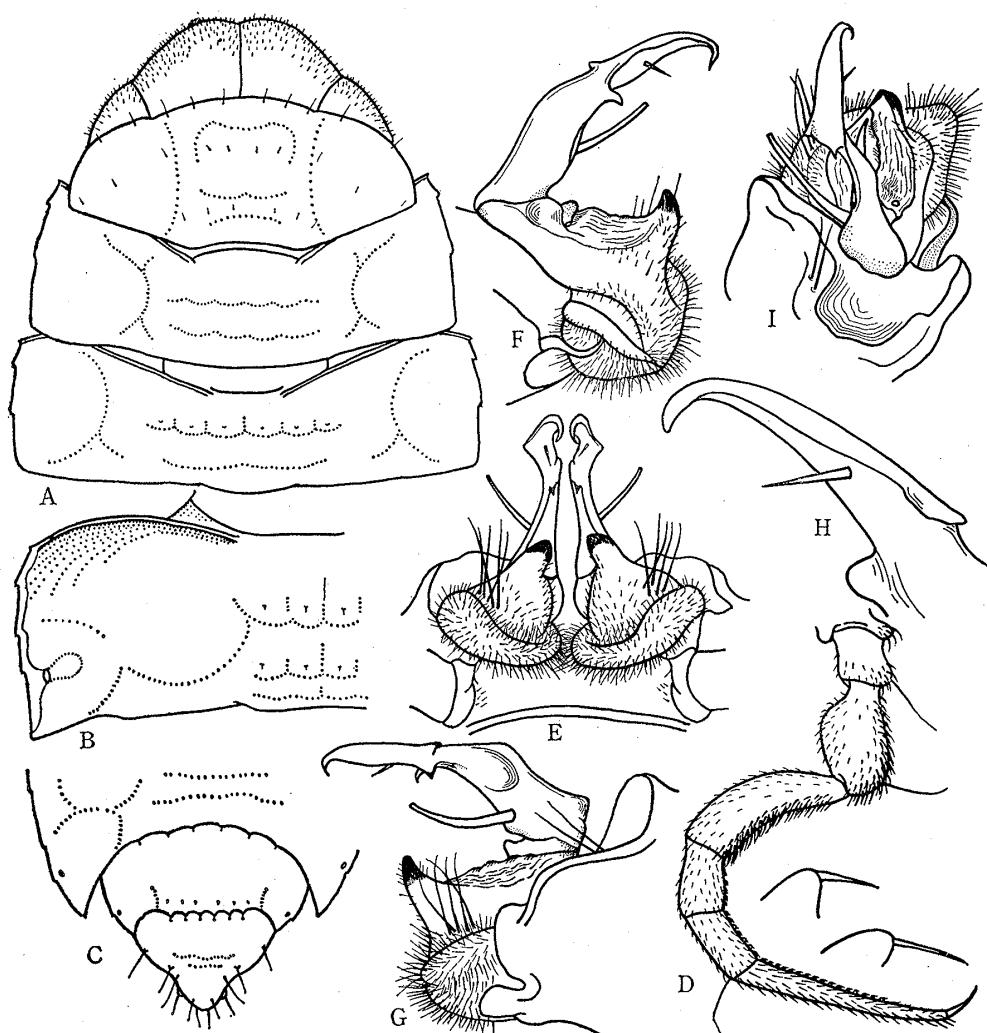


Fig. 2. *Epanerchodus angulatus* n. sp., holotype. A, Head and three succeeding segments, dorsal aspect. B, Segment 10, dorsal aspect. C, Caudal end of body, dorsal aspect. D, Left leg on segment 10. E, Gonopods, *in situ*, caudo-ventral aspect. F, Left gonopod, mesial aspect. G, The same, lateral aspect. H, Terminal portion of tibiotarsus of gonopod. I, Left gonopod, frontal aspect.

processes and a peculiar seta on the distal half; tibiotarsal branch very long and slender, though very fragile and can be observed only in perfect specimens. Post-femoral process very small and verrucose.

Female paratype: Length about 26 mm. Similar in appearance to the male holotype except that sternites of segments 4-6 are normal and that the legs have no peculiar bristles.

Type-series: 3♂♂, 3♀♀, 8 larvae, 22-23 July 1968, lava cave called "Anano-hara-dō", at Ike of Itō City, Shizuoka Pref., coll. by T. Maenami; 1♂ (holotype), 1♀, 2 larvae, 15 May 1969, coll. by M. Ohrai.

Additional specimens from the same cave: 1♂, 1♀, 2 larvae, 23 September

1968; 1♂, 27 May 1969; 1♂, larva, 18 April 1969; 1♀, 4 larvae, 28 April 1969. All the specimens were collected by M. Ohrui.

Notes: Ana-no-hara-dō Cave is situated at the northwestern foot of Mt. Ohmuroyama, about 7 km south of Itō City in the Izu Peninsula of Shizuoka Prefecture. According to Mr. Ohrui, the cave is a kind of pit, 24 m long, about 20 m wide and 15 m deep, with two branch passages on either side of the bottom of the entrance pit. The present milliped is usually found in these branches. Mr. Ohrui is now studying the life history of this milliped.

Polydesmus tanakai n. sp.

(Japanese name: Erabu Motoobiyasude)

Diagnosis: A small epigean species similar in appearance to *P. miyosii* Murakami (1966, p. 95, fig. 2), from which it can be distinguished by the male gonopods characterized in the following particulars: coxa with two distal long setae; soleonomerite elongate, ventrally with two tiny processes and a conspicuous hair-cushion; tibiotarsus with small bifid subterminal process, but without branch.

Male holotype: Color pale brown in alcohol. Length about 15 mm, greatest width 2 mm. Body small, slender, parallel-sided between segments 7 and 13, and gradually narrowing toward both ends. Width values of head and of some selected segments as follows:

Head = 1.3 mm	Collum = 1.2 mm	Seg. 2 = 1.4 mm
Seg. 4 = 1.7 mm	Seg. 6 = 1.9 mm	Seg. 7 = 2.0 mm
Seg. 14 = 1.9 mm	Seg. 16 = 1.7 mm	Seg. 18 = 1.2 mm.

Head normal in appearance, oval, convex, covered with short hairs. Antennae moderately long clavate, reaching back to the middle of segment 4. Length relationship of articles $3 > 6 > 5 > 4 > 1 = 2 > 7$; the ratio in length and in width (in parentheses) of articles 5 through 7 is 12(5): 13(7): 5(5); last three articles without peculiar sensory hair and prominence. Collum elliptical, narrower than head or succeeding segments, and slightly arched; relatively clear sculpture present on the surface; anterior and lateral sides marginate, having no lateral notches. Succeeding segments each slightly elevated on dorsum, with moderately developed lateral keels, and with the usual pattern of clear sculpture on dorsum and keels. Lateral keels narrower than long (ratio of W:L = 18:23 in segment 10), marginate, nearly transverse and horizontal, though somewhat bent forward on segments 2-3; lateral margin slightly convex, with 3-4 weak notches which usually bear no bristles; each posterior corner becoming gradually produced from segment 6; tooth of segment 19 small; anterior margin slightly convex in most of the segments; segments 7 through 18 provided with microscopic strigilis on the surface. Pores small, open on the dorsal surface close to the lateral margin, and situated by the fourth notch of pore-bearing keels. Sterna quadrate, pubescent and with rather deep transverse furrow, all not produced on posterior corners; on segment 6, anterior sternum markedly rising and densely covered with bristles, but posterior sternum deeply

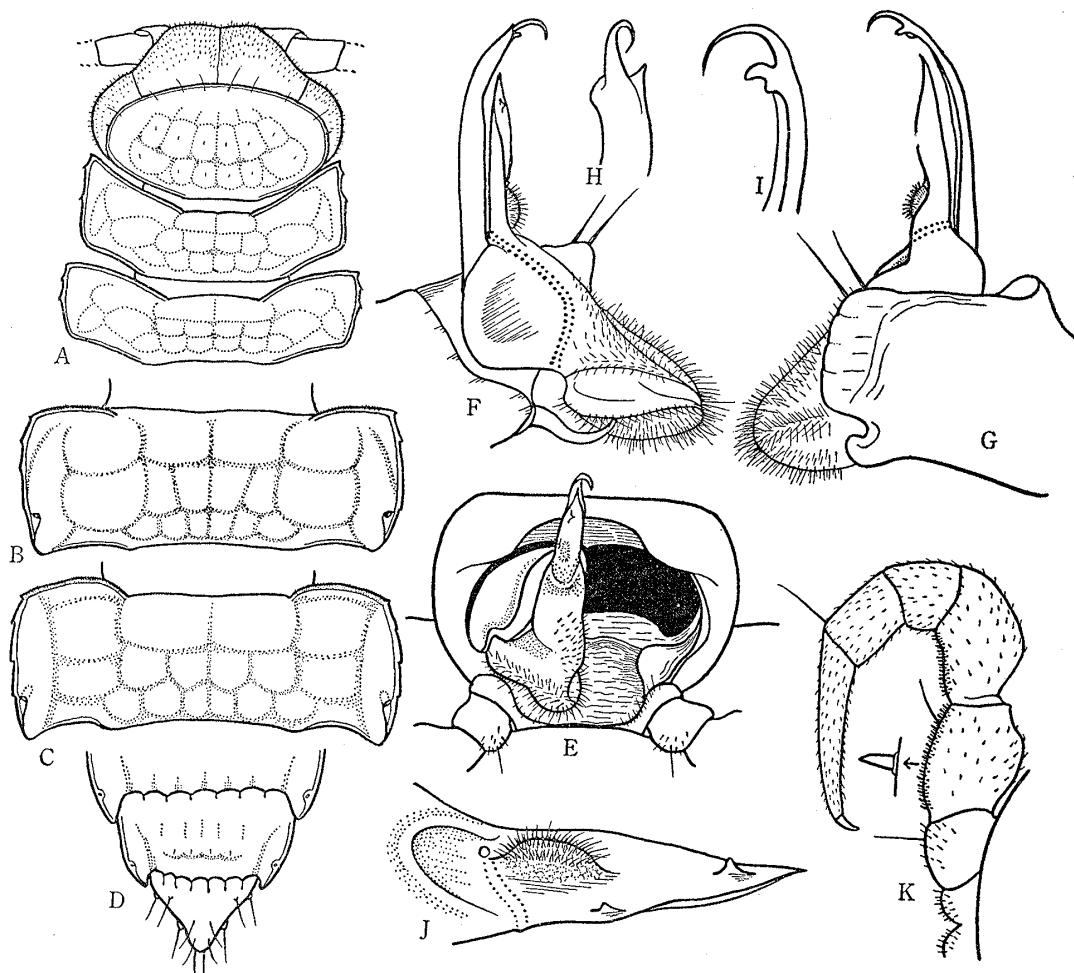


Fig. 3. *Polydesmus tanakai* n. sp., holotype. A, Head and three succeeding segments, dorsal aspect. B, Segment 7, dorsal aspect. C, Segment 10, dorsal aspect. D, Caudal end of body, dorsal aspect. E, Ventral aspect of segment 7, *in situ*, showing gonopodal aperture. F, Left gonopod, mesial aspect. G, The same, lateral aspect. H-I, Showing terminal portion of tibiotarsus of gonopod. J, Solenomerite, ventral aspect. K, Left leg on segment 8.

depressed. Legs relatively short and not so slender. Length relationships of podomeres: $6 > 2 = 3 > 5 > 4 > 1$; prefemur and femur rather robust, slightly protuberant on the upper side, and with dense strong bristles on the under surface, the other podomeres slenderer, sparsely setose; no spherical bristles; pretarsus short and not so acute.

Gonopodal aperture large, transversely oval, extending laterad beyond ends of coxal sockets of segment 7, lower edge of the posterior side slightly concave and the upper edge obviously extending forward to form a broad shelf; sternum of segment 7 broadly depressed between coxae of 8th legs, and the surface rugose. Gonopods of the form shown in Figure 3, E-J and of moderate size; *in situ*, telo-

podites lying parallel to the axis of body and adjoining each other. Coxa large, cylindrical, with two distal long setae, and roughly wrinkled at the terminal area on the outer side. Femoral portion somewhat broadened distad, inner side flattened, and with a projecting solenomerite. Tibiotarsus long and slender, projecting cephalad, the distal portion with a small bifid subterminal process and an elongate hook-shaped terminal projection. Solenomerite slender and leaf-like, with two tiny processes and a conspicuous haircushion on the ventral surface as illustrated in text-figure 3, J. Seminal canal circularly curved at the base of solenomerite, and open at the posterior side of the hair-cushion. Female unknown.

Type-specimen: 1♂, 9 May 1968, collected by Shingo Tanaka in Shôryû-dô Cave, at Sumiyoshi in China-chô, Is. Okinoerabu-jima, one of the Amami group of the Ryukyus.

Notes: Two species of the genus *Polydesmus* have previously been reported in Japan: *P. japonicus* Miyosi, 1955, from Oze in Gunma Pref., and *P. miyosii* Murakami, 1966, from Tanbara-chô in Ehime Pref. The present new species is the third record of the genus from the Japanese Islands. These Far Eastern species seem to be near to the European members of the subgenus *Nomarchus* (Attems, 1940, p. 22) in the shape of their gonopods.

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